PCT / IB 99 / 00850
29. 04. 99

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IB99/00850

09/674079

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Patentanmeldung Nr. Patent application No. Demande de brevet n°

98401075.1

PRIORITY DOCUMENT

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

Anmeldung Nr.:
Application no.: 98401075.1
Demande n°:

Anmeldetag:
Date of filing: 29/04/98
Date de dépôt:

Anmelder:
Applicant(s):
Demandeur(s):
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Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:
Receiver/decoder and method of processing video data

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

Staat: State: Pays:	Tag: Date: Date:	Aktenzeichen: File no. Numéro de dépôt:

Internationale Patentklassifikation:
International Patent classification:
Classification internationale des brevets:
/

Am Anmeldetag benannte Vertragstaaten:
Contracting states designated at date of filing: AT/BE/CH/DE/DK/ES/FI/FR/GB/GR/IE/IT/LI/LU/MC/NL/PT/SE
Etats contractants désignés lors du dépôt:

Bemerkungen:
Remarks:
Remarques:

RECEIVER/DECODER AND METHOD OF PROCESSING VIDEO DATA

The present invention relates to a receiver/decoder and a method of processing video data.

The term "receiver/decoder" used herein may connote a receiver for receiving either encoded or non-encoded signals, for example, television and/or radio signals, which may be broadcast or transmitted by some other means. The term may also connote a decoder for decoding received signals. Embodiments of such receiver/decoders may include a decoder integral with the receiver for decoding the received signals, for example, in a "set-top box", such a decoder functioning in combination with a physically separate receiver, or such a decoder including additional functions, such as a web browser, a video recorder, or a television.

In a broadcast digital television system, received signals are passed to a receiver/decoder and thence to a television set. As used herein, the term "digital television system" includes for example any satellite, terrestrial, cable and other system. The receiver/decoder decodes a compressed MPEG-type signal into a television signal for the television set. It is controlled by a remote controller handset, through an interface in the receiver/decoder. The receiver/decoder is used to process the incoming bit stream, and includes a variety of application modules which cause the receiver/decoder to perform a variety of control and other functions.

Such a receiver/decoder may have a variety of devices coupled to it, such as a card reader for the user to pass an authorization card through to confirm which services the user is authorized to use, a hand-held television receiver control wand, a television display unit, and a second card reader for use with bank cards to allow the user to perform home banking functions. It may also have a variety of ports coupled to it, for example, a modem for access to the Internet and for conducting home banking

has been fully received in the data buffer area, a central processing unit in the receiver/decoder, under the control of a device, passes icon data into the data buffer area, preferably just before the data stored in the data buffer area is combined with other data to provide video data. Hence, the invention affords the advantage that in the event of an overlap between the icon and part of the subtitle, the icon can be laid over that part of the subtitle, but the non–overlapped parts can be concurrently displayed with the icon.

In a preferred embodiment, the data buffer area comprises two data buffer sub–areas, said incoming display data being directed into one of said sub–areas at a time.

The two sub–areas may be interchanged so that further incoming display data is stored in the other sub–area and graphics data stored in the graphics buffer area is passed to the other sub–area. This can enable a subtitle screen to be stored in one sub–area whilst a previously received subtitle screen is being output from another sub–area, thereby avoiding over–writing of the previously received subtitle screen with fresh data.

Preferably, the two sub–areas are interchanged immediately after graphics data stored in the graphics buffer area is passed to one of the data buffer sub–areas.

The graphics buffer area may comprise a plurality of graphics buffer sub–areas in which graphics data can be stored, graphics data being passed to the data buffer area from a selected one of the graphics buffer sub–areas. This can enable, for example, a number of different icons to be generated and stored prior to the reception of any video text data, so that there is no need for icon generating means to generate continuously icon data.

Preferably, the combined graphics and display data is further combined with other received data to provide video data. Thus, whilst further incoming display data is

specified by said control means.

The receiver/decoder may further comprise means for interchanging the two sub-areas so that further incoming display data is storable in the other sub-area and graphics data stored in the graphics buffer area is passable to the other sub-area.

The interchanging means may be adapted to interchange the two data buffer sub-areas immediately after graphics data stored in the graphics buffer area is passed to one of the data buffer sub-areas.

The graphics buffer area may comprise a plurality of graphics buffer sub-areas in which graphics data is storable, graphics data being passable to the data buffer area from a selected one of the graphics buffer sub-areas.

The receiver/decoder may further comprise means for combining the combined graphics and display data with other received data to provide video data.

The passing means may be arranged to pass graphics data stored in the graphics buffer area into the data buffer area for combination with display data stored therein immediately before combining means combines the combined graphics and display data with said other received data.

The receiver/decoder may further comprise buffer control means, the data buffer sub-areas being defined by the buffer control means.

The present invention also extends to a broadcast and reception system including a receiver/decoder as aforementioned, and means for broadcasting said data. In a preferred embodiment, the system is a digital television system.

Various functions of the receiver/decoder may be implemented in hardware, for

scrambler 4 by linkage 5.

The multiplexer 4 receives a plurality of further input signals, assembles the transport stream and transmits compressed digital signals to a transmitter 6 of the broadcast centre via linkage 7, which can of course take a wide variety of forms including telecommunications links. The transmitter 6 transmits electromagnetic signals via uplink 8 towards a satellite transponder 9, where they are electronically processed and broadcast via notional downlink 10 to earth receiver 12, conventionally in the form of a dish owned or rented by the end user. The signals received by receiver 12 are transmitted to an integrated receiver/decoder 13 owned or rented by the end user and connected to the end user's television set 14. The receiver/decoder 13 decodes the compressed MPEG-2 signal into a television signal for the television set 14.

Other transport channels for transmission of the data are of course possible, such as terrestrial broadcast, cable transmission, combined satellite/cable links, telephone networks etc.

In a multichannel system, the multiplexer 4 handles audio and video information received from a number of parallel sources and interacts with the transmitter 6 to broadcast the information along a corresponding number of channels. In addition to audiovisual information, messages or applications or any other sort of digital data may be introduced in some or all of these channels interlaced with the transmitted digital audio and video information.

A conditional access system 15 is connected to the multiplexer 4 and the receiver/decoder 13, and is located partly in the broadcast centre and partly in the decoder. It enables the end user to access digital television broadcasts from one or more broadcast suppliers. A smartcard, capable of deciphering messages relating to commercial offers (that is, one or several television programmes sold by the broadcast supplier), can be inserted into the receiver/decoder 13. Using the decoder 13 and

The decoder 13 comprises a central processor 20 including associated memory elements and adapted to receive input data from a serial interface 21, a parallel interface 22, a modem 23 (connected to the modem back channel 17 of Fig. 1), and switch contacts 24 on the front panel of the decoder.

The decoder is additionally adapted to receive inputs from an infra-red remote control 25 via a control unit 26 and also possesses two smartcard readers 27, 28 adapted to read bank or subscription smartcards 29, 30 respectively. The subscription smartcard reader 28 engages with an inserted subscription card 30 and with a conditional access unit 29 to supply the necessary control word to a demultiplexer/descrambler 30 to enable the encrypted broadcast signal to be descrambled. The decoder also includes a conventional tuner 31 and demodulator 32 to receive and demodulate the satellite transmission before being filtered and demultiplexed by the unit 30.

Processing of data within the decoder is generally handled by the central processor 20. Figure 3 illustrates the software architecture of the central processor 20 of the receiver/decoder. With reference to Figure 3, the software architecture comprises a Run-Time-Engine 4008, a Device Manager 4068 and a plurality of Devices 4062 and Device Drivers 4066 for running one or more applications 4056.

As used in this description, an application is a piece of computer code for controlling high level functions of preferably the receiver/decoder 13. For example, when the end user positions the focus of remote control 25 on a button object seen on the screen of the television set 14 and presses a validation key, the instruction sequence associated with the button is run.

An interactive application proposes menus and executes commands at the request of the end user and provides data related to the purpose of the application. Applications may be either resident applications, that is, stored in the ROM (or FLASH or other non-volatile memory) of the receiver/decoder 13, or broadcast and downloaded into

manipulation such as compression, expansion or comparison of data structures, line drawing, etc. The library 4006 also includes information about firmware in the receiver/decoder 13, such as hardware and software version numbers and available RAM space, and a function used when downloading a new device 4062. Functions can be downloaded into the library, being stored in FLASH or RAM memory.

The run time engine 4008 is coupled to a device manager 4068 which is coupled to a set of devices 4062 which are coupled to device drivers 4060 which are in turn coupled to the ports or interfaces. In broad terms, a device driver can be regarded as defining a logical interface, so that two different device drivers may be coupled to a common physical port. A device will normally be coupled to more than one device driver; if a device is coupled to a single device driver, the device will normally be designed to incorporate the full functionality required for communication, so that the need for a separate device driver is obviated. Certain devices may communicate among themselves.

As will be described below, there are 3 forms of communication from the devices 4064 up to the run time engine: by means of variables, buffers, and events which are passed to a set of event queues.

Each function of the receiver/decoder 13 is represented as a device 4062 in the software architecture of the receiver/decoder 13. Devices can be either local or remote. Local devices 4064 include smartcards, SCART connector signals, modems, serial and parallel interfaces, a MPEG video and audio player and an MPEG section and table extractor. Remote devices 4066, executed in a remote location, differ from local devices in that a port and procedure must be defined by the system authority or designer, rather than by a device and device driver provided and designed by the receiver/decoder manufacturer.

The run time engine 4008 runs under the control of a microprocessor and a common

Before using the services of any device 4062, a program (such as an application instruction sequence) has to be declared as a "client", that is, a logical access-way to the device 4062 or the device manager 4068. The manager gives the client a client number which is referred to in all accesses to the device. A device 4062 can have several clients, the number of clients for each device 4062 being specified depending on the type of device 4062. A client is introduced to the device 4062 by a procedure "Device: Open Channel". This procedure assigns a client number to the client. A client can be taken out of the device manager 4068 client list by a procedure "Device: Close Channel".

The access to devices 4062 provided by the device manager 4068 can be either synchronous or asynchronous. For synchronous access, a procedure "Device: Call" is used. This is a means of accessing data which is immediately available or a functionality which does not involve waiting for the desired response. For asynchronous access, a procedure "Device: I/O" is used. This is a means of accessing data which involves waiting for a response, for example scanning tuner frequencies to find a multiplex or getting back a table from the MPEG stream. When the requested result is available, an event is put in the queue of the engine to signal its arrival. A further procedure "Device: Event" provides a means of managing unexpected events.

As noted above, the main loop of the run time engine is coupled to a variety of process sequencer units, and when the main loop encounters an appropriate event, control is temporarily transferred to one of the process sequencer units.

Thus, it can be seen that the central processor 20 provides a platform having considerable flexibility in enabling an application to communicate with a variety of devices.

In the case of received audio and video signals, the MPEG packets containing these

The moving image layer is used for the incoming video signals obtained from the MPEG data stream. The circuitry and software associated with the moving image layer buffer area 44 can preferably resize and scale the incoming images, and combine images from a plurality of sources into different areas of the buffer area.

The graphics layer is used to produce titles and icons (graphics). Titles are frequently subtitles, which appear centred near the lower edge of the image, but may also appear in other positions on the image. Icons are generally geometric shapes such as rectangles, circles, buttons, and dialogue boxes (it will be realized that the term "icon" is here being used in a broad sense).

The graphics layer is defined by one or more rectangular regions, each rectangular region being defined by the coordinates of the upper left corner of the region and the size of the region. Accordingly, the graphics layer buffer area 45 is sub–divided into a plurality of buffer regions 45A, 45B, ... 45N, one buffer region for each of the rectangular regions of the graphics layer. Each buffer region 45A... comprises a plurality of sub–areas $45A^0$, $45A^1$...$45A^n$. Each buffer region is created by a "subtitle" device 4062, under the control of an application 4056, in the central processor 20 using a command procedure stored in the graphics library 42.

With reference to Figure 6, the contents of the stills layer buffer area 43 and the moving image layer buffer area 44, as they are read out, are mixed together by a mixing circuit 50 which can be set to blend (alpha blending, that is, translucently) those outputs; and the output of that mixing circuit 50 is combined with the contents of the graphics layer buffer area 45, as those contents are read out, by a similar mixing circuit 51.

The output of that mixing circuit is combined with the output of a hardware cursor generator 52 by a combining circuit 53 which superposes a cursor signal on the combination of the first 3 layers. The cursor layer is preferably superposed opaquely,

areas each time the working buffer has a new complete subtitle page to display, as the contents of that sub-area are no longer changing, giving a steady image which is acceptable to the viewer so that sub-area can be used as the display buffer. The contents of the display buffer are read out as the graphics layer for combination with the combined stills layer and moving image layer. The interval between the interchange of the roles of the two sub-areas $45A^0$ and $45A^1$, that is, between the interchange of the working and display buffers, is typically 5 to 10 s. At that point, the subtitle device 4062 in the central processor 20 outputs an appropriate command to the graphic processor 36 to interchange the roles of the two sub-areas $45A^0$ and $45A^1$, and, in turn, the microprocessor 41 of the graphic processor 36 clears the contents of the other sub-area and directs incoming data to that sub-area.

Each buffer region 45A, 45B... includes a further buffer area, namely an icon buffer area $45A^i$, $45B^i$...., as shown in Figure 5. Each icon buffer area $45A^i$ comprises one or more icon buffer sub-areas, $45A^2$, $45A^3$... up to $45A^{15}$. Each icon buffer sub-area contains respective icon image data. The icon image may be generated by software stored in the central processor 20, stored in the RAM area 20A (or FLASH memory area) of the central processor 20 and copied by the central processor 20 into a designated icon buffer sub-area of the RAM area 41 of the graphic processor 36. Once an icon image has been stored in the graphic processor 36, it remains in its buffer sub-area and can be copied repeatedly to either of the two buffer sub-areas $45A^0$ and $45A^1$ whenever required. In this way, a whole series of icon images can be constructed, which can be used in whatever sequences and at whatever times are required.

The combination of the two images, the subtitles image in one or other of the buffer sub-areas $45A^0$ and $45A^1$ and the icon image in the icon buffer area $45A^i$, is achieved by copying the icon image into the working buffer, that is, into whichever of the two sub-areas $45A^0$ and $45A^1$ is not currently the display buffer. As specified by the controlling application, the subtitle device 4062 outputs an appropriate command to

integrated circuits capable of performing the operations required in the receiver/decoder are commercially available or can be readily designed, and these can be used as the basis for a hardware accelerator, or more preferably modified to produce a dedicated hardware accelerator, to implement various of the operations required, thereby reducing the processing power required to run the software. However, the operations required may be implemented in software if sufficient processing power is available.

The modules and other components have been described in terms of the features and functions provided by each component, together with optional and preferable features. With the information given and specifications provided, actual implementation of these features and the precise details are left to the implementor. As an example, certain modules could be implemented in software, preferably written in the C programming language and preferably compiled to run on the processor used to run the application; however, some components may be run on a separate processor, and some or all components may be implemented by dedicated hardware.

The above modules and components are merely illustrative, and the invention may be implemented in a variety of ways, and, in particular, some components may be combined with others which perform similar functions, or some may be omitted in simplified implementations. Hardware and software implementations of each of the functions may be freely mixed, both between components and within a single component.

It will be readily understood that the functions performed by the hardware, the computer software, and such like are performed on or using electrical and like signals. Software implementations may be stored in ROM, or may be patched in FLASH.

It will be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the

CLAIMS

1. A method of processing video data in a receiver/decoder comprising at least one port for receiving data and memory means comprising a data buffer area for storing incoming data for display, and a graphics buffer area for storing graphics data, said method comprising passing graphics data stored in the graphics buffer area to the data buffer area for combination with display data stored therein.

2. A method according to Claim 1, wherein the data buffer area comprises two data buffer sub–areas, said incoming display data being directed into one of said sub–areas at a time.

3. A method according to Claim 2, wherein the two sub–areas are interchanged so that further incoming display data is stored in the other sub–area and graphics data stored in the graphics buffer area is passed to the other sub–area.

4. A method according to Claim 3, wherein the two sub–areas are interchanged immediately after graphics data stored in the graphics buffer area is passed to one of the data buffer sub–areas.

5. A method according to any preceding claim, wherein the graphics buffer area comprises a plurality of graphics buffer sub–areas in which graphics data is stored, graphics data being passed to the data buffer area from a selected one of the graphics buffer sub–areas.

6. A method according to any preceding claim, wherein the combined graphics and display data is further combined with other received data to provide video data.

7. A method according to Claim 6, wherein graphics data stored in the graphics buffer area is passed into the data buffer area for combination with display data stored

the other sub-area and graphics data stored in the graphics buffer area is passable to the other sub-area.

15. A receiver/decoder according to Claim 14, wherein the interchanging means is adapted to interchange the two data buffer sub-areas immediately after graphics data stored in the graphics buffer area is passed to one of the data buffer sub-areas.

16. A receiver/decoder according to any of Claims 11 to 15, wherein the graphics buffer area comprises a plurality of graphics buffer sub-areas in which graphics data is storable, graphics data being passable to the data buffer area from a selected one of the graphics buffer sub-areas.

17. A receiver/decoder according to any of Claims 11 to 16, further comprising means for combining the combined graphics and display data with other received data to provide video data.

18. A receiver/decoder according to Claim 17, wherein the passing means is arranged to pass graphics data stored in the graphics buffer area into the data buffer area for combination with display data stored therein immediately before combining means combines the combined graphics and display data with said other received data.

19. A broadcast and reception system including a receiver/decoder according to any of Claims 11 to 18, and means for broadcasting said data.

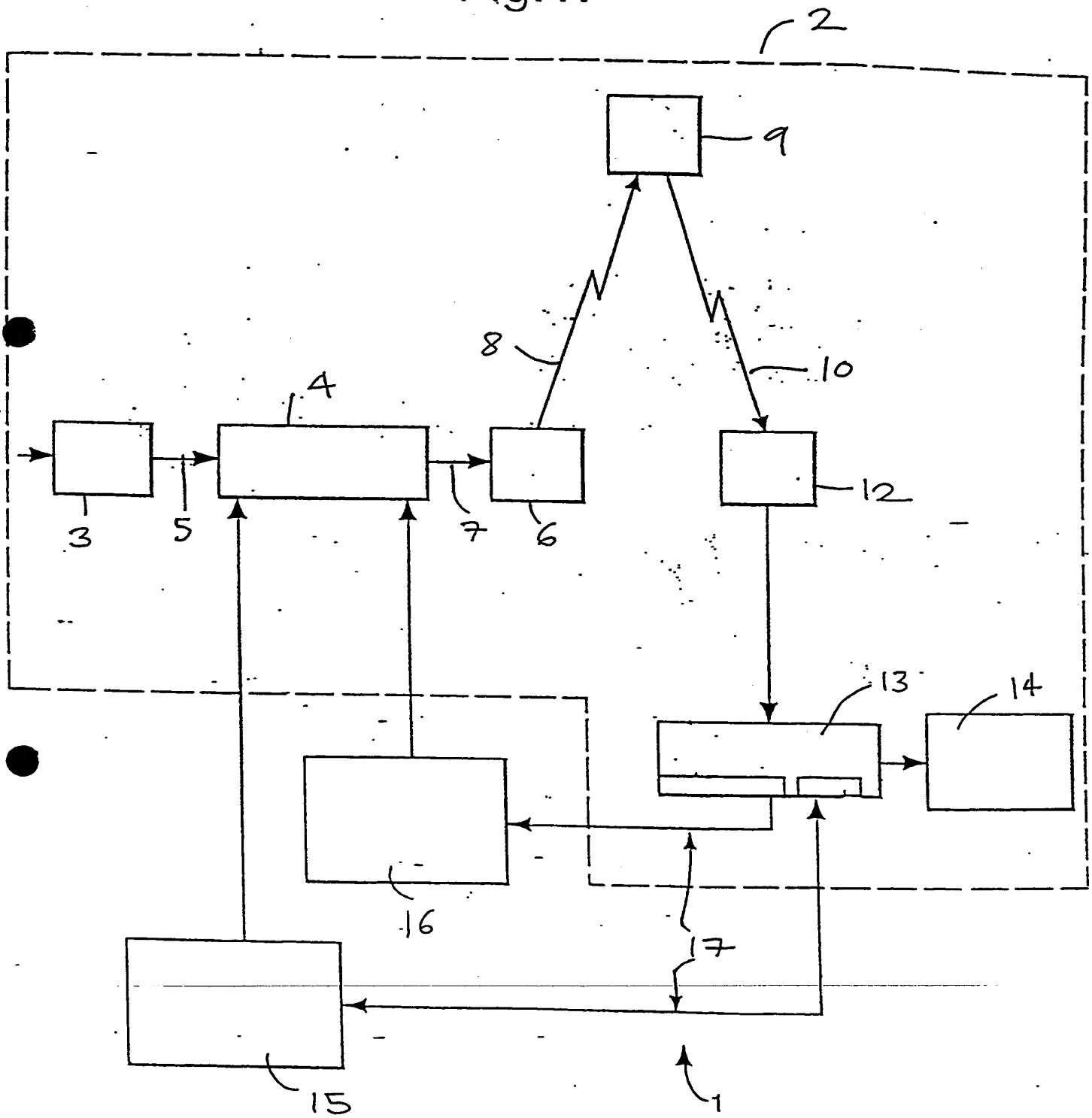
ABSTRACT

RECEIVER/DECODER AND METHOD OF PROCESSING VIDEO DATA

A method of processing video data in a receiver/decoder comprising at least one port 31 for receiving data and memory means 40 comprising a data buffer area $45A^0$, $45A^1$ for storing incoming data for display, and a graphics buffer area $45A^i$ for storing graphics data, said method comprising passing graphics data stored in the graphics buffer area to the data buffer area for combination with display data stored therein.

Figure 4

Fig.1.



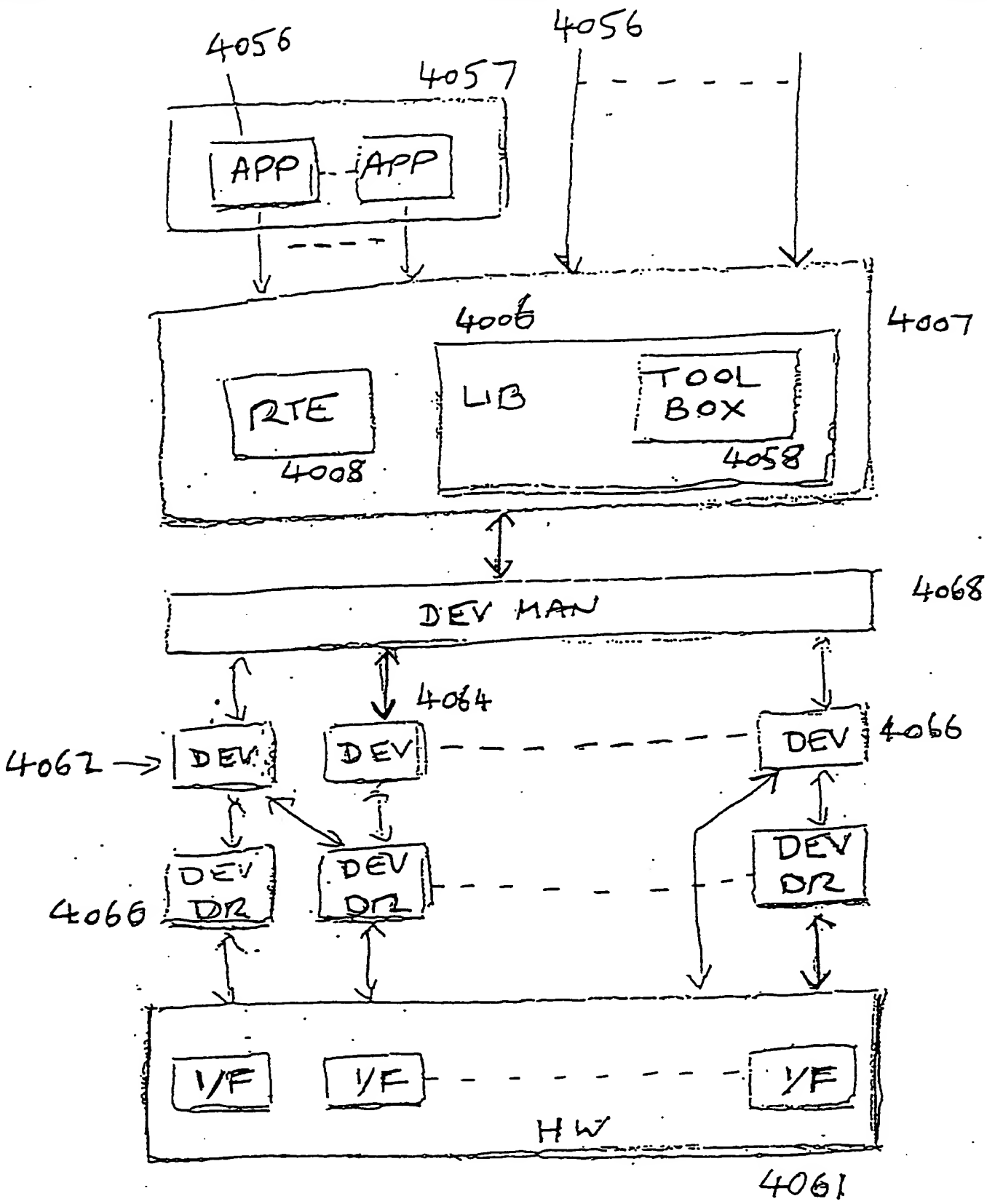

4056
4056
4057
APP
APP
4006
4007
RTE
4008
LIB
TOOL BOX
4058
DEV MAN
4068
4064
4062
DEV
DEV
DEV
4066
DEV DR
DEV DR
4066
DEV DR
I/F
I/F
I/F
HW
4061

Fig. 3

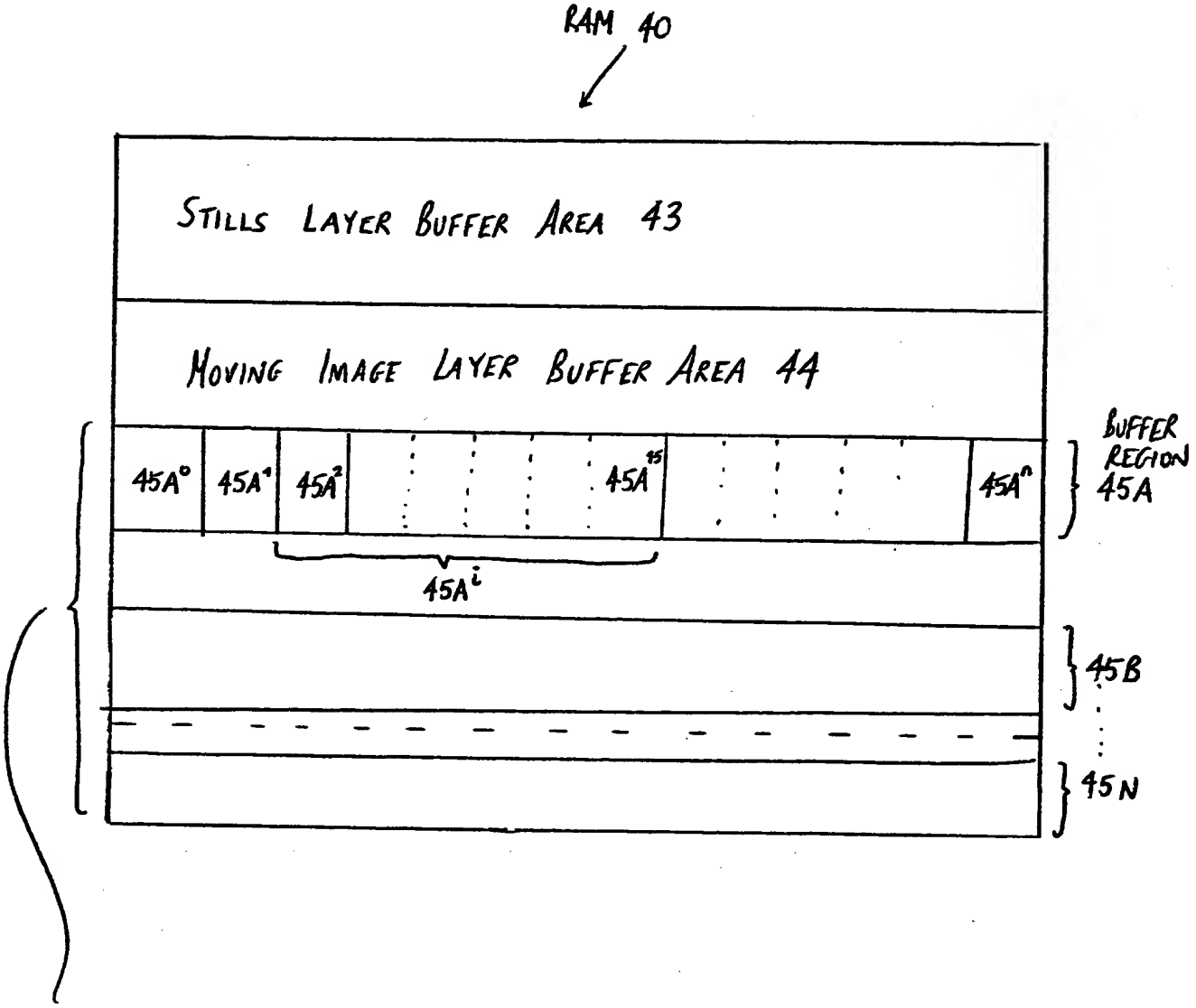

RAM 40
STILLS LAYER BUFFER AREA 43
MOVING IMAGE LAYER BUFFER AREA 44
45A0
45A1
45A2
45Ai
45A15
45An
BUFFER REGION 45A
45B
45N
GRAPHICS LAYER BUFFER AREA 45

FIGURE 5